BEST MANAGEMENT PRACTICES

Farm Forestry and Habitat Management

Agriculture Canada

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If you're thinking about changes to your farm operation, you need to consider:

- ▸ production goals
- ▸ financial implications
- ▸ environmental impact.

Every booklet in the Best Management Practices series presents realistic production alternatives to help you develop a sustainable farm plan.

The team of extension staff, researchers, and farmers behind each booklet has developed a variety of options, so that you can select those that fit your operation.

Eight booklets in the Best Management Practices series are now available or will be in the near future. These are:

- ▸ *A First Look*
- ▸ *Livestock and Poultry Waste Management*
- ▸ *Field Crop Production*
- ▸ *Horticultural Crops*
- ▸ *Farm Forestry and Habitat Management*
- ▸ *Water Management**
- ▸ *Soil Management**
- ▸ *Nutrient Management**
- ▸ *Wildlife Management***

*Available January 1994

**Available Spring 1994

After you've read the booklet, please take a minute to complete the enclosed readership survey. We'll use your response to guide us in future Best Management Practices booklets and projects. Postage will be paid by us. Thank you for your time.

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Where to Find the Answers

Key

BOOKLET 2:
▶ Livestock and Poultry Waste Management

BOOKLET 3:
▶ Field Crop Production

BOOKLET 4:
▶ Horticultural Crops

BOOKLET 5:
▶ Farm Forestry and Habitat Management

Save Money

REDUCE FERTILIZER INPUTS:
- ▶ ▶ Nutrient Management
- ▶ Manure Handling and Storage
- ▶ ▶ Manure Application Systems
- ▶ ▶ Cover Crops and Rotation
- ▶ ▶ ▶ ▶ Soil Erosion Control (see Save the Soil)

REDUCE PESTICIDE INPUTS:
- ▶ ▶ Pest Management

ELIMINATE REPLANTING:
- ▶ ▶ ▶ ▶ Control Soil Erosion (see Save the Soil)

REDUCE ENERGY INPUT:
- ▶ ▶ Tillage Options
- ▶ Windbreaks and Shelterbelts
- ▶ Woodlot Management

REDUCE BUILDING MATERIAL COST:
- ▶ Woodlot and Plantation Management

BETTER TIME MANAGEMENT:
- ▶ ▶ Tillage Options
- ▶ Manure Handling and Storage
- ▶ ▶ Manure Application Systems
- ▶ ▶ Crop Rotation
- ▶ Woodlot Management

INCREASED YIELDS:
- ▶ ▶ Tillage Options
- ▶ ▶ Rotation
- ▶ ▶ ▶ ▶ Soil Erosion Control (see Save the Soil)
- ▶ Windbreaks and Shelterbelts
- ▶ ▶ ▶ Improve Soil Structure

Save the Soil

WATER EROSION CONTROL:
- ▶ ▶ Cover Crops and Crop Rotation
- ▶ Erosion Control Structures
- ▶ ▶ Tile Drainage
- ▶ Strip Cropping
- ▶ ▶ Buffer Strips
- ▶ Contouring
- ▶ Grass Headlands
- ▶ ▶ Tillage Options
- ▶ Intercropping
- ▶ Fragile Land Retirement

IMPROVE SOIL STRUCTURE AND REDUCE COMPACTION:
- ▶ ▶ Cover Crops and Crop Rotation
- ▶ ▶ Tile Drainage
- ▶ Grass Headlands
- ▶ ▶ Tillage Options
- ▶ ▶ Proper Application of Livestock Manures

WIND EROSION CONTROL:
- ▶ Tree Windbreaks and Natural Fencerows
- ▶ Vegetative Wind Barriers
- ▶ ▶ Cover Crops
- ▶ ▶ Tillage Options
- ▶ ▶ Strip Cropping

FRAGILE LAND RETIREMENT:
- ▶ Reforestation
- ▶ ▶ Buffer Strips
- ▶ Fencing to Prevent Livestock Access to Streams
- ▶ Wildlife Habitat Plantings

STREAMBANK PROTECTION:
- ▶ ▶ Buffer Strips
- ▶ Tile Outlet Protection
- ▶ Rock Protection on Banks
- ▶ Wildlife Habitat
- ▶ Low-flow Livestock and Machinery Stream Crossing

RELIEVING TILLAGE TRANSLOCATION:
- ▶ Reforestation and Intercropping
- ▶ ▶ Tillage Options
- ▶ ▶ Cover Crops and Crop Rotations
- ▶ Contouring
- ▶ Strip Cropping

Save the Water

CONTROLLING NITRATE LEVELS:
- ▶ Manure Handling and Storage
- ▶ ▶ Manure Application Systems
- ▶ Milkhouse Waste Storage and Treatment Systems
- ▶ ▶ Nutrient Management
- ▶ ▶ Cover Crops and Crop Rotations

CONTROLLING PHOSPHATE LEVELS:
- ▶ Manure Handling and Storage
- ▶ ▶ Manure Application Systems
- ▶ Milkhouse Waste Storage and Treatment Systems
- ▶ ▶ Nutrient Management
- ▶ ▶ ▶ ▶ Soil Erosion Control (see Save the Soil)

REDUCE SEDIMENT LOSS:
- ▶ ▶ ▶ ▶ Soil Erosion Control (see Save the Soil)

REDUCE BACTERIA LEVELS:
- ▶ Manure Handling and Storage
- ▶ ▶ Manure Application Systems
- ▶ Milkhouse Waste Storage and Treatment Systems
- ▶ Fencing to Prevent Livestock Access to Streams
- ▶ Low-flow Livestock Stream Crossing

PROPER PESTICIDE MANAGEMENT:
- ▶ ▶ Pest Management
- ▶ ▶ ▶ ▶ Soil Erosion Control (see Save the Soil) for Pesticides Attached to Soil

ADEQUATE WATER SUPPLY:
- ▶ ▶ Tile Drainage
- ▶ Irrigation and Water Table Management
- ▶ ▶ Water Conservation-Residue Management
- ▶ Water Conservation-Maintaining Trees

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FARM FORESTRY AND HABITAT MANAGEMENT

Trees and agriculture are intimately tied together.

Plant one tree each spring. If you read no further, or when the rest of this booklet is all but forgotten, remember to plant one tree each spring. The earth needs more trees and your farm will benefit too.

If it has to do with woodlots, windbreaks, watercourses, wetlands, and wildlife, then there's information in this booklet. The information found in the following pages offers an understanding of where, how and to what extent nature can blend with farming. Both the environment and your pocket book can benefit from this union.

This booklet is intended to get you started but cannot replace on-site advice. Such advice is available at no cost from the Ministry of Natural Resources (MNR), Ontario Ministry of Agriculture and Food (OMAF), and Conservation Authorities (CAs). Check the final section for telephone numbers.

Tree products can be very profitable. Crop and livestock yields can be greatly increased with shelter from trees. The environmental benefits of trees and natural areas are vital to the quality of all of our lives.

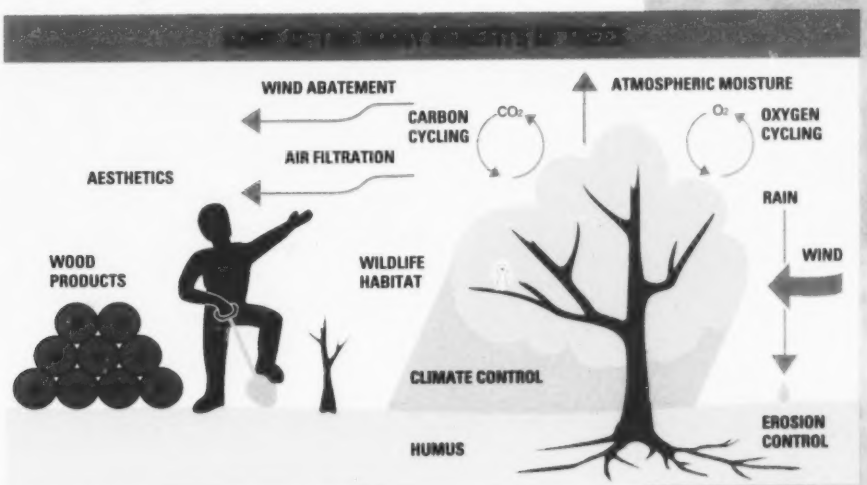
The differences between farmland and natural areas are familiar to all of us. The environmental impact of these two areas is less clear. Not all impacts are severe and not all farms have negative impacts upon environmental quality. Some of the potential problems related to agriculture are listed below:

- ▸Increased soil erosion by wind, water and tillage.
- ▸Streams can be clouded by sediment and contaminated by leached or eroded fertilizers (especially phosphorus) and pesticides.

Extension staff are available to assist in on-site advice and planning.

- ▸Sediment can cover and destroy fish spawning areas.
- ▸Sediment fills up expensive reservoirs.
- ▸Lack of stream-side vegetation increases the water's exposure to sunlight. Algae-choked water becomes too warm and oxygen-poor for trout and many other fish species.
- ▸Where streams are crossed by livestock, the banks become eroded and animal wastes contaminate the water.
- ▸Risk of flooding and streambank erosion may increase because of the rapid drainage of water from farm fields into drains and other watercourses; less rainfall is directed to groundwater.
- ▸The variety of living things decreases.
- ▸Suitable wildlife habitat exists only in isolated woodlots or natural areas, and therefore, many animals do not have enough space to satisfy their needs.
- ▸Higher wind speeds resulting from a lack of tree cover can decrease crop yields.
- ▸Loss of topsoil through erosion reduces productivity and requires increased inputs of fertilizer, etc.
- ▸Impact of drought is intensified.

This booklet describes a number of best management practices for farm forestry and habitat management. Each practice can reduce some of the impacts listed above; most also offer financial benefits. This booklet is an introductory guide. More detailed information is available from sources mentioned throughout.



Trees help reduce negative impacts of agriculture.

PLANNING FOR FORESTRY AND HABITAT MANAGEMENT

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Behind every great farm is a great plan. A plan helps organize ideas and activities. It will help identify needs, opportunities, limitations, and expectations. It helps you step back and take a long-term, broad view of the farm, and to balance economics, operations and the environment. The plan will point to solutions to resource management problems. The illustrations show common land uses on the farm and some best management practices that might be applied. The table on page 10 rates the suitability of practices for various land uses. The table on page 9 will help you through the planning process step-by-step.

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Farmstead consists of buildings (such as the barn and house), lane, yard, and garden.

Cropland is cultivated for field crops. Orchards and other specialty cropland are handled in separate booklets.

Pasture is land grazed by livestock.

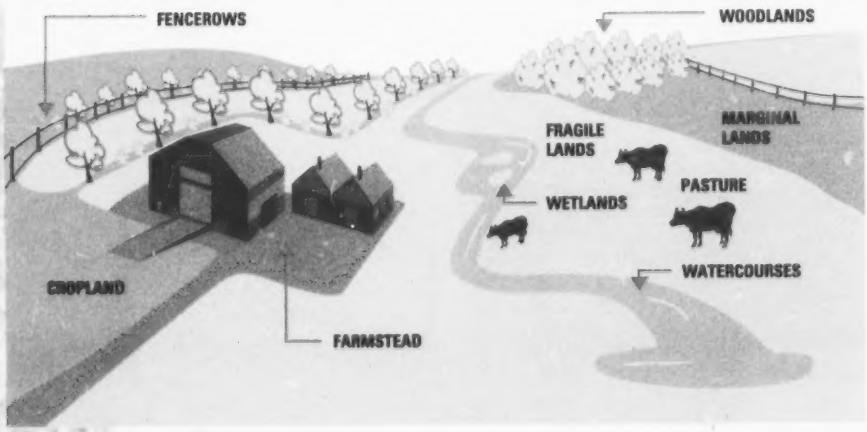
Fragile lands are tilled lands subject to one or more of the following: severe wind or water erosion, flooding, or tillage-induced erosion.

Marginal lands have soil that is too stony, too wet, too shallow, too steep or too dry for profitable farming.

Woodlands are all areas with permanent tree cover.

Wetlands are depressional areas that are seasonally or permanently covered by shallow water (but not well drained floodplains).

Watercourses include streams, ditches, rivers, ponds and their shorelines.



Land uses on the farm.

Windbreaks and **shelterbelts** are bands of trees and shrubs designed to shelter crops, livestock, soil and buildings and to control snow accumulation.

Natural fencerows are volunteer growth along existing fence lines which make excellent habitat and fairly good windbreaks.

Reforestation is block plantings that return open land to forest.

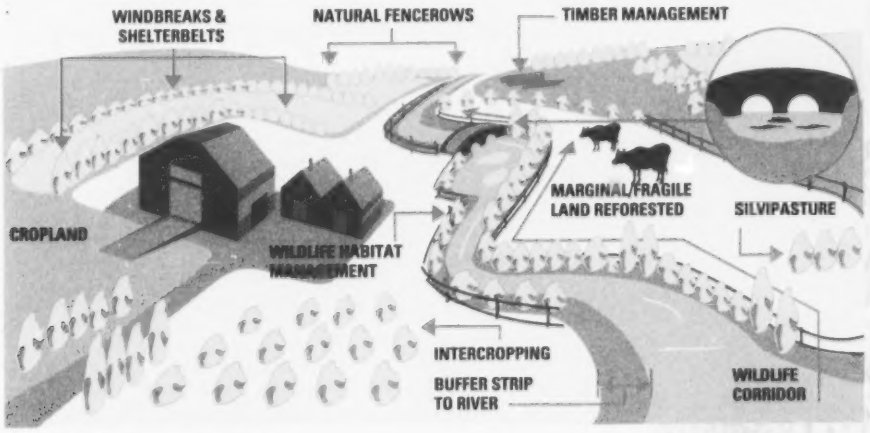
Buffer strips are strips of vegetation which protect natural areas (especially watercourses) from surrounding land uses.

Intercropping means establishing trees in cropland while continuing to grow field crops between the trees.

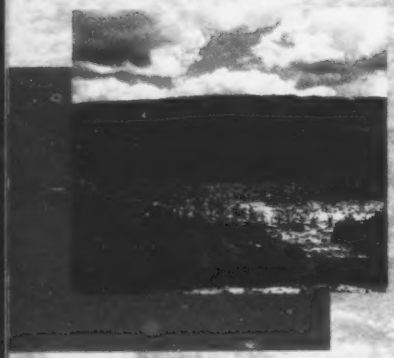
Silvipasture means establishing trees in pasture (but not grazing woodlots).

Wildlife habitat management, where possible, should be a part of all farming activities but is also a best management practice of its own. Any improvement to the farm's ability to provide and control the needs of wildlife is called habitat management.

Woodlot management seeks to improve the farm woodlot.

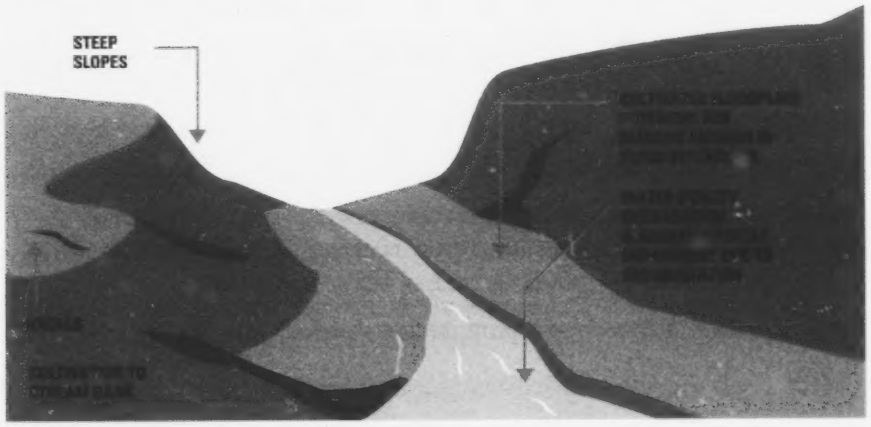


Some best management practices.



Fragile land clearly showing loss of crop productivity.

So much topsoil erodes from fragile lands that its retirement is a top priority for many government assistance programs. CAs and MNR provide subsidized planting services and nursery stock for these lands. Additional funding is often available. OMAF staff can advise you on agricultural funding programs.



Types of fragile lands.

Fragile Lands

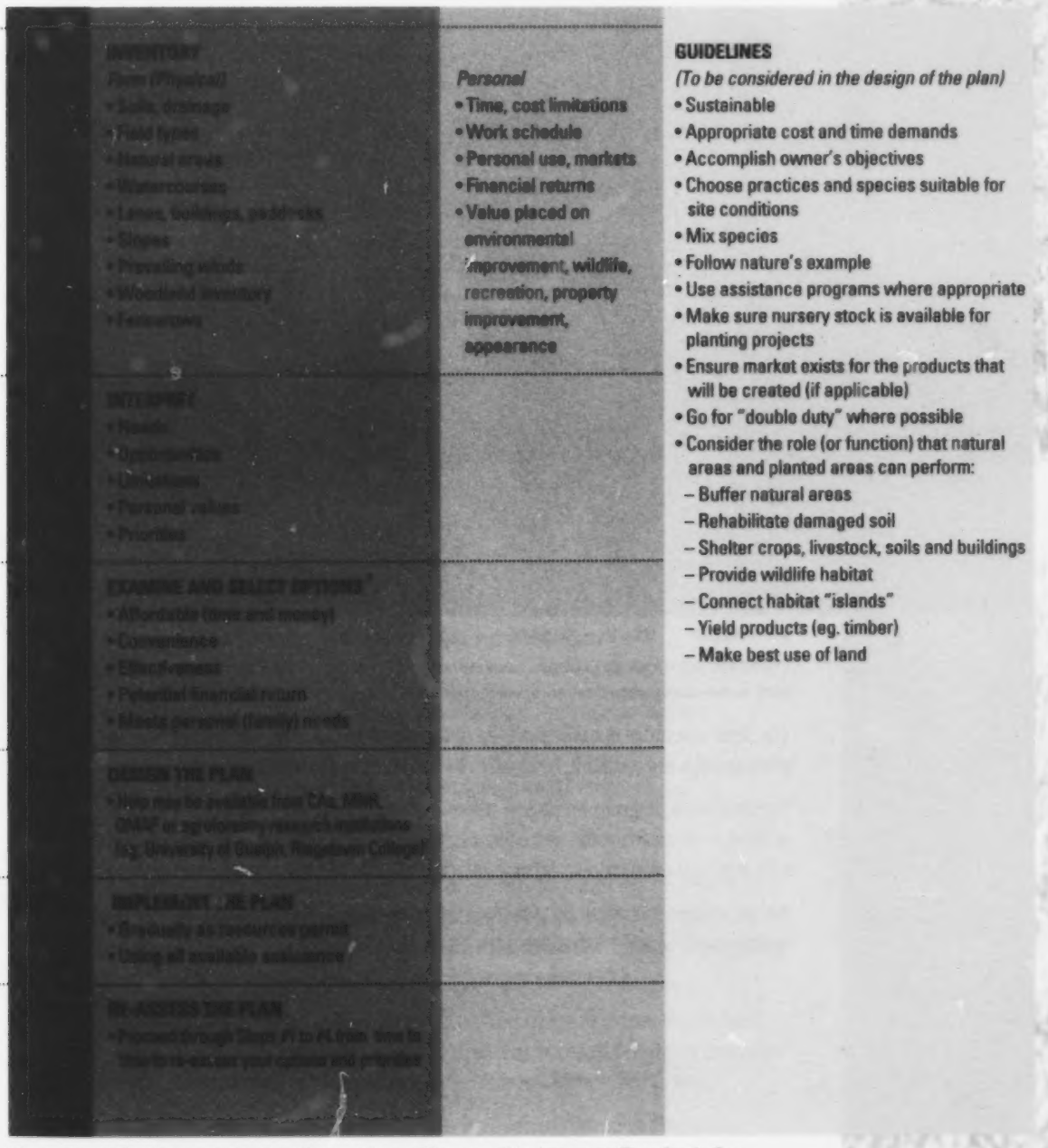
Fragile lands may be profitable to farm but are easily damaged by traditional farming methods. Row cropping on steep slopes, knolls, floodplains, and right up to creek banks are examples of tillage on fragile lands.

Exposed soil on fragile land erodes quickly, causing loss of productivity as shown above. The sediment that moves off the land can cause great harm to the environment, especially water quality.

Marginal Lands

Marginal lands are not profitable to farm. Steep, dry, shallow, extremely stony, or very poorly-drained soils are classed as marginal. Although this land is marginal for agriculture, it can produce valuable forests and natural areas.

Conifer plantations are commonly used to retire marginal land.


Personal
• Time, cost limitations
• Work schedule
• Personal use, markets
• Financial returns
• Value placed on environmental improvement, wildlife, recreation, property improvement, appearance
GUIDELINES
(To be considered in the design of the plan)
• Sustainable
• Appropriate cost and time demands
• Accomplish owner's objectives
• Choose practices and species suitable for site conditions
• Mix species
• Follow nature's example
• Use assistance programs where appropriate
• Make sure nursery stock is available for planting projects
• Ensure market exists for the products that will be created (if applicable)
• Go for "double duty" where possible
• Consider the role (or function) that natural areas and planted areas can perform:
– Buffer natural areas
– Rehabilitate damaged soil
– Shelter crops, livestock, soils and buildings
– Provide wildlife habitat
– Connect habitat "islands"
– Yield products (eg. timber)
– Make best use of land

1 Browse through "Best Management Practices" Section, talk to neighbours, get advice from experts. The options (or Best Management Practices) must be screened for the items in Step #3.

PLANNING FOR FARM FORESTRY AND HABITAT MANAGEMENT

STEP #1 **INVENTORY**

Farm (Physical)
- Soils, drainage
- Field types
- Natural areas
- Watercourses
- Lanes, buildings, paddocks
- Slopes
- Prevailing winds
- Woodland inventory
- Fencerows

Personal
- Time, cost limitations
- Work schedule
- Personal use, markets
- Financial returns
- Value placed on environmental improvement, wildlife, recreation, property improvement, appearance

STEP #2 **INTERPRET**
- Needs
- Opportunities
- Limitations
- Personal values
- Priorities

STEP #3 **EXAMINE AND SELECT OPTIONS** [1]
- Affordable (time and money)
- Convenience
- Effectiveness
- Potential financial return
- Meets personal (family) needs

STEP #4 **DESIGN THE PLAN**
- Help may be available from CAs, MNR, OMAF or agroforestry research institutions (eg. University of Guelph, Ridgetown College)

STEP #5 **IMPLEMENT THE PLAN**
- Gradually as resources permit
- Using all available assistance

STEP #6 **RE-ASSESS THE PLAN**
- Proceed through Steps #1 to #4 from time to time to re-assess your options and priorities

GUIDELINES

(To be considered in the design of the plan)
- Sustainable
- Appropriate cost and time demands
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SUITABILITY OF OPTIONS WITH LAND USES ON THE FARM

	FARMSTEAD	CROPLAND	PASTURE	FRAGILE LAND	MARGINAL LAND	WOODLAND	WETLAND	OTHER SURFACE WATER*
WINDBREAKS AND SHELTERBELTS	VS	VS	S	S	S	S	–	S
NATURAL FENCEROWS	S	S	S	S	VS	–	–	–
PLANTATIONS	S	–	–	S	VS	–	–	–
BUFFER STRIPS	–	–	–	–	–	VS	VS	VS
WILDLIFE HABITAT MANAGEMENT	VS	S	S	VS	VS	VS	VS	VS
INTERCROPPING	–	VS	–	VS	S	–	–	–
SILVIPASTURE	–	–	VS	–	VS	–	–	–
WOODLOT MANAGEMENT	–	–	–	–	S	VS	–	–

S = Suitable VS = Very Suitable – = Less Suitable

* OTHER SURFACE WATER: Ditches, creeks, ponds and lakes.

NOTE: As tree plantings mature, they may be used for timber.

The farm inventory is easily mapped out from an aerial view. Inexpensive aerial photographs are available from MNR to help in this process.

The land uses diagram on page 6 offers many different opportunities. A long-term vision of what is possible on the same farm is shown on the next page. If you have trouble with this step on your own farm, contact MNR, OMAF or the local CA to get on-site advice.

Not every best management practice suits every situation. Each land use has best management practices that are most fitting for it.

	PASTURE	FRAGILE LAND	MARGINAL LAND	WOODLAND	WETLAND	OTHER SURFACE WATER*
	S	S	S	S	–	S
	S	S	VS	–	–	–
	–	S	VS	–	–	–
	–	–	–	VS	VS	VS
	S	VS	VS	VS	VS	VS
	–	VS	S	–	–	–
	–	–	VS	–	–	–
	–	–	S	VS	–	–

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BEST MANAGEMENT PRACTICES

All trees and natural areas offer valuable benefits to society and the environment. The following environmental benefits are provided by all farm forestry best management practices:

- ▸All growing trees take carbon out of the atmosphere and so, counteract the greenhouse effect.
- ▸Trees clean the air of many other pollutants.
- ▸Trees hold, shelter, and improve the soil.
- ▸Trees and wetlands are beneficial to the water cycle, smoothing out wet and dry periods like a flywheel. In addition, they filter and clean water.
- ▸Trees beautify and add diversity to the landscape.
- ▸Trees and natural areas provide habitat for wildlife.

Close to home is an excellent place to plant trees. The following checklist shows important benefits trees can offer around the farmstead:

- ▸Provide comfort with shade and shelter.
- ▸Shelter buildings (10 to 30% energy savings are common).
- ▸Beautify with different colours, shapes and texture.
- ▸Control snow drifting.
- ▸Screen views and noise sources.
- ▸Create wildlife habitat.
- ▸Provide food (berries, apples, etc.).
- ▸Increase property value.

Who Qualifies?

Many best management practices are encouraged by government funding programs. But who qualifies? Rules and minimum qualifications are different for every program. CAs, MNR and OMAF set priorities according to local needs. This makes it difficult to generalize about who qualifies for programs; however, farm properties usually do.

Stay in touch with OMAF staff regarding sources of funding aimed at promoting these practices on farms. Contact MNR and the CA in your area and ask what programs they offer. Private groups such as Boy Scouts or Hunters and Anglers are sometimes able to assist.

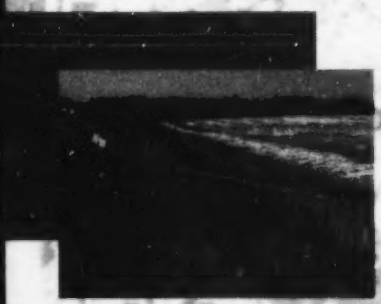
In general, the types of assistance mentioned in this booklet are aimed at properties greater than two hectares in size.

A farmstead with trees is a more attractive and comfortable place to live and work.

Double Duty

Through creative design, species selection, or intensive management, each best management practice can be made to do double (triple, quadruple...) duty. For example, a windbreak can produce timber, habitat and nuts in addition to shelter.

Wind erosion is still common in Ontario.



A young spruce/pine windbreak will soon shelter soil and crops.

A Summary:

Windbreaks and shelterbelts slow down wind speeds near the ground. They can offer protection to soil, crops, livestock, buildings and people. Windbreaks have five or less rows; shelterbelts have six or more.

USEFUL WITH:	▸ cropland and fragile land ▸ farmstead ▸ pasture and marginal land ▸ woodlands and watercourses
FAVOURED SPECIES:	▸ Norway spruce, blue spruce, white spruce, white cedar, Carolina poplar, Scots pine, ash, maple. Any species that can tolerate wind may be used. See the table on page 15
ADVANTAGES:	▸ reduce soil erosion ▸ increase crop yields ▸ increase livestock productivity ▸ decrease energy needs in sheltered buildings ▸ increase comfort level for people ▸ provide wildlife habitat ▸ produce firewood, fruit, nuts ▸ control snow accumulation ▸ increase property value ▸ shelter pollinating insects ▸ shelter beneficial animals
DISADVANTAGES:	▸ take away some workable land ▸ compete with a few rows of crops ▸ may interfere with tile drains ▸ poorly managed windbreaks will leave undesirable accumulations of snow at field edge, could delay planting ▸ may hamper desirable crop drying ▸ good maintenance required ▸ smaller fields for cultivating ▸ potential for pesticide damage to trees ▸ may harbour pest animals and weeds close to fields
ESTABLISHMENT COST:	▸ low
PROFIT POTENTIAL:	▸ high (eg. increased crop productivity in sheltered zone)
PROFIT HORIZON:	▸ break-even point (when increased crop yields offset losses from shading and land loss) reached after 15 to 20 years
SITE PREPARATION:	▸ tillage or herbicide application
ESTABLISHMENT:	▸ assistance available in most areas
MAINTENANCE:	▸ re-planting and thinning to maintain desired density of 40 to 60%
INFORMATION & ASSISTANCE:	▸ CAs (where they exist) should be your first contact for information, on-site advice and planting assistance. Trees are available through CAs or directly from MNR. Check with OMAF staff regarding cost-sharing programs to encourage windbreaks
REFERENCE:	▸ Windbreaks On the Farm, OMAF Publication #527

The Details:

Properly-designed windbreaks and shelterbelts put money into the owner's pocket. They have long been promoted for erosion control and farmstead protection, with good reason. The benefits for crop and livestock productivity are not as well-known but offer some of the best reasons to establish windbreaks:

- ▸Sheltering livestock from storms and cold winds allows them to turn energy into meat instead of heat. Summer shade is vital for livestock.
- ▸Most crops yield more in sheltered fields than when exposed. Crops benefit from direct protection from storms, better growing conditions, and more available moisture during drought.
- ▸Buildings can be heated with 10 to 30% less fuel when sheltered. Farmstead shelterbelts act as outdoor insulation.

In all these examples, the windbreaks more than make up for the loss of productive land which they cover.

It is important to realize that tree windbreaks are not the only method of reducing soil erosion. Please refer to the booklet on Field Crop Production for information on strip cropping, conservation tillage, residue management and other techniques. These are all effective tools to reduce erosion.

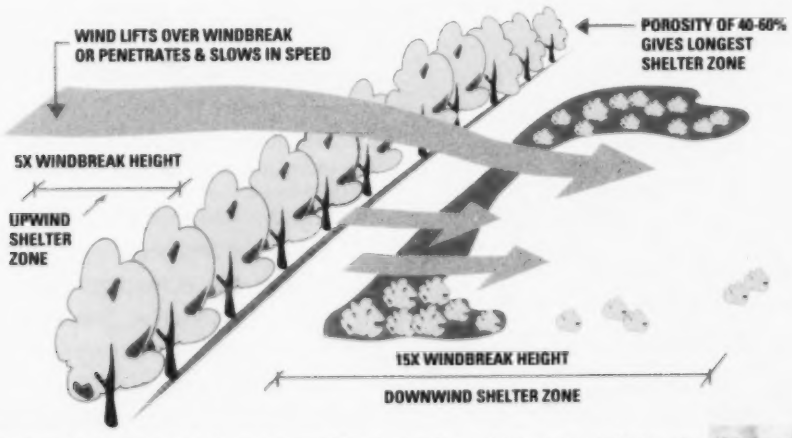
Some important factors to consider when planning a windbreak are shown in the diagram. They include:

- ▸Continuity (ie. no gaps, if possible). Gaps create wind tunnels.
- ▸Plant at right angle to prevailing or most troublesome wind.

Replacement of aging windbreaks should be planned early.

Double Duty with Field Windbreaks

- ▸ **Connect isolated natural areas to double as wildlife corridors.**
- ▸ **Locate the windbreak along a watercourse to double as a buffer.**
- ▸ **Manage the windbreak for firewood or timber production.**
- ▸ **Establish wildlife food plants along windbreaks.**
- ▸ **Include nut trees for nuts, wood and shelter.**



Windbreaks decrease winds near ground level, creating a sheltered zone that is about 20 times as wide as the windbreak is high. Increased productivity in this zone makes farming more profitable.

Windbreaks too close to roads or lanes cause accumulation problems. Pruning of lower branches can sometimes solve this problem.

Double Duty "Down Under"

In New Zealand, windbreaks are commonly managed for timber production. The upwind species in a two-row windbreak is a dense, slow-growing tree similar to our white cedar, and the downwind row is a fast-growing pine. The pine is pruned throughout its life and then harvested for lumber. The pine row is replanted in the shelter of the slow-growing species and the process is repeated.

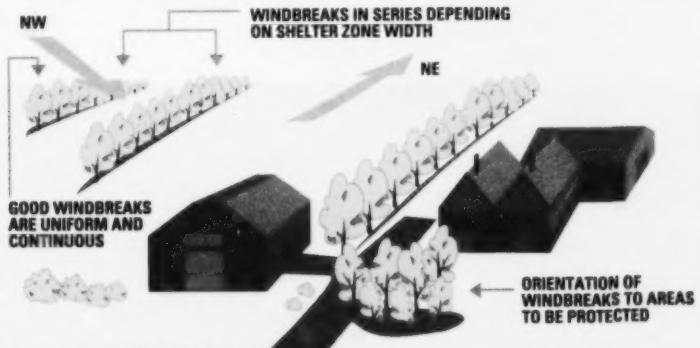
- ▸Windbreak should extend beyond whatever is to be sheltered.
- ▸Most farms need a series of windbreaks for complete protection.
- ▸Uniformity.
- ▸Likely soil/crop combinations to be used.
- ▸Existing shelter (e.g. wooded areas).
- ▸Existing and possible field layouts.
- ▸Desired width of sheltered zone and desired field width.
- ▸Site/tree compatibility.
- ▸Tile drainage.

The windbreak should be as close as possible to a right angle to the prevailing or most troublesome winds. For maximum protection, a good rule-of-thumb is to have a tall windbreak every 200 metres, or a shorter one every 100 metres. Short windbreaks need to be planted closer together to protect an area properly.

Spacing between trees and rows varies from 1.2 to 3 metres, depending on access needs and tree size. Please see the "How To" section on page 41 for tree maintenance tips.

The most important thing to know about windbreak spacing is that it requires continuous management.

Trees may be planted close together to shelter each other in the early years. However, they always need space to grow and to allow light to reach bottom branches for as long as possible. The density of the windbreak should be uniform, without gaps and around 40 to 60% porosity (like a snowfence). Constant care is needed to re-plant and to thin out as required.


NW
WINDBREAKS IN SERIES DEPENDING ON SHELTER ZONE WIDTH
NE
GOOD WINDBREAKS ARE UNIFORM AND CONTINUOUS
ORIENTATION OF WINDBREAKS TO AREAS TO BE PROTECTED

Some important factors in windbreak planning include orientation, continuity, uniformity, and shelter zone width.

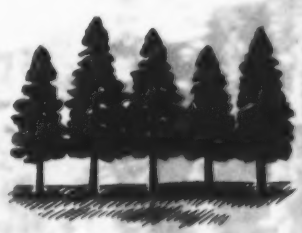
Live Snow Fences

Trees and shrubs can control snow drifting around the farmstead. Compared to artificial snow fences, these live snow fences are cheaper, more permanent, more effective, better looking and provide wildlife habitat.

The live snow fence should be planted on the upwind side of the area needing protection, and it must be far enough away to avoid snow accumulation in the area requiring protection. This distance is at least 13 metres (40 feet) for a low barrier such as a cedar hedge, but should be increased to 25 or 30 metres (up to 100 feet) for barriers consisting of large trees.

	FAIR (IMPERFECT)	POOR
	Norway Spruce Red Pine Austrian Pine White Cedar Windbreak Poplar Silver Maple Black Locust	Norway Spruce Silver Maple Green Ash White Cedar White Spruce
	Norway Spruce Austrian Pine Red Pine White Cedar Windbreak Poplar Green Ash Silver Maple Black Locust	Silver Maple Green Ash Norway Spruce White Cedar White Spruce
	Norway Spruce Silver Maple White Spruce Green Ash White Cedar Black Locust Windbreak Poplar	Silver Maple Green Ash Norway Spruce White Spruce
	Green Ash Silver Maple Norway Spruce White Spruce Windbreak Poplar	Silver Maple Green Ash White Spruce

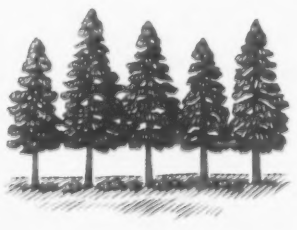
NOTES: For each texture-drainage combination, the most suitable species is listed first. The next most suitable is second and so on. White pine is not recommended for a single or two-row field windbreak but may be used in multiple-row shelterbelts around farmsteads.



SUITABILITY OF TREE SPECIES TO ONTARIO SOIL TYPES

SURFACE TEXTURE	NATURAL DRAINAGE		
	GOOD	*FAIR (IMPERFECT)*	*POOR*
COARSE (SANDY)	Austrian Pine Norway Spruce Red Pine White Spruce Black Locust White Cedar Windbreak Poplar	Norway Spruce Red Pine Austrian Pine White Cedar Windbreak Poplar Silver Maple Black Locust	Norway Spruce Silver Maple Green Ash White Cedar White Spruce
MEDIUM (COARSE LOAMY)	Norway Spruce Austrian Pine Red Pine White Cedar White Spruce Windbreak Poplar Black Locust	Norway Spruce Austrian Pine Red Pine White Cedar Windbreak Poplar Green Ash Silver Maple Black Locust	Silver Maple Green Ash Norway Spruce White Cedar White Spruce
FINE (FINE LOAMY)	Norway Spruce White Spruce White Cedar Windbreak Poplar Green Ash Black Locust	Norway Spruce Silver Maple White Spruce Green Ash White Cedar Black Locust Windbreak Poplar	Silver Maple Green Ash Norway Spruce White Spruce
VERY FINE (CLAYEY)	Norway Spruce White Spruce Green Ash Black Locust White Cedar	Green Ash Silver Maple Norway Spruce White Spruce Windbreak Poplar	Silver Maple Green Ash White Spruce

NOTES: For each texture-drainage combination, the most suitable species is listed first. The next most suitable is second and so on. White pine is not recommended for a single or two-row field windbreak but may be used in multiple-row shelterbelts around homesteads.



Natural fencerows can provide excellent habitat.

A Summary:

Natural Fencerows are the "volunteer" growth of trees and shrubs around old fences and field borders.

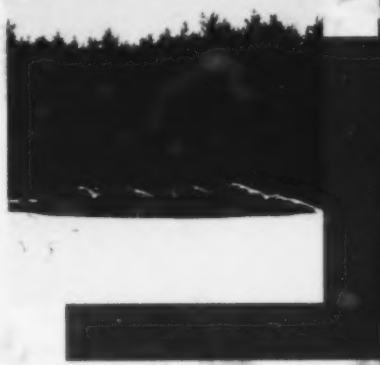
USEFUL WITH:	▸farmstead ▸cropland ▸pasture ▸wherever fences exist
FAVOURED SPECIES:	▸natural growth, unless being managed for a specific goal (eg. timber production)
ADVANTAGES:	▸fairly effective windbreaks ▸good wildlife habitat ▸excellent connecting links for habitat ▸can produce firewood and other products ▸shelter beneficial animals ▸shelter pollinating insects ▸some reduction of soil erosion ▸some increase in soil yields
DISADVANTAGES:	▸not as effective as conifer windbreaks ▸may interfere with tiles ▸use workable land ▸may harbour pest animals close to fields
ESTABLISHMENT COST:	▸none to moderate
PROFIT POTENTIAL:	▸low to moderate
PROFIT HORIZON:	▸short
SITE PREPARATION:	▸none for existing fencerows
ESTABLISHMENT:	▸none for existing fencerows
MAINTENANCE:	▸pruning to keep fields clear, improve timber quality, and increase productivity of fruit trees. If a fencerow is to be created, it could be quite demanding in terms of finances and labour. Fencerows could also be treated as very widely-spaced intercropping. Refer to Wildlife Habitat and Intercropping sections if a fencerow is to be so treated
INFORMATION & ASSISTANCE:	▸MNR and CA field staff in forestry or wildlife management are available to offer free on-site advice
REFERENCE:	▸Community Wildlife Involvement Program Field Manual (MNR)

A Summary:

Reforestation means establishing and maintaining permanent forest cover on previously open land. The goal can be either to maintain the plantation with the original species mix or to use planting to accelerate the process of succession.

USEFUL WITH:	▸marginal and fragile land ▸farmstead
FAVOURED SPECIES:	▸white pine, red pine, white spruce, Norway spruce, white cedar, European larch, tamarack, black walnut, red oak, white ash, green ash, silver maple, black locust, and windbreak poplar are available from MNR. Many other species can be used too
ADVANTAGES:	▸protect and improve soil ▸may offer best use of easily damaged or unproductive land ▸provide wildlife habitat ▸yield a variety of timber products ▸beautify and improve recreation ▸increase property value ▸potential long-term income ▸increasing forest cover can improve water cycle ▸conifer plantations require little maintenance
DISADVANTAGES:	▸low rate of return ▸long wait for income
ESTABLISHMENT COST:	▸none or low if subsidized, otherwise moderate
PROFIT POTENTIAL:	▸moderate
PROFIT HORIZON:	▸very long
SITE PREPARATION:	▸varies
ESTABLISHMENT:	▸assistance available
MAINTENANCE:	▸weed control
INFORMATION & ASSISTANCE:	▸MNR and most CAs offer subsidized planting services and free on-site advice. Affordable nursery stock is available from MNR. Check with OMAF staff for agricultural funding programs that encourage land retirement
REFERENCE:	▸Trees: A Handy Guide for People Who Want to Put Down Roots, MNR; Hardwood Planting on Abandoned Farmland in Southern Ontario, Forestry Canada, Box 490, Sault Ste. Marie, Ontario P6A 5M7

Marginal lands, such as the ridge in the background, are excellent candidates for reforestation.



Plantation protecting and restoring fragile land.

Plantations should be thinned out periodically.

The Details:

Changing to a crop that requires less management input and less cultivation is a good solution for both fragile and marginal land. For example, permanent hay or pasture may replace row cropping. Reforestation provides a way to retire land. Although it is commonly called retirement, the land can be very productive, both environmentally and economically, while growing a forest.

Government-sponsored reforestation programs are commonly used in Ontario. These programs tend to focus on getting the most acres planted with the least cost and maintenance. Conifers, such as pines and spruces, are easily established with little site preparation or maintenance (and less damage from rodents and other wildlife). For this reason most plantations are coniferous. As with any crop, trees are most productive when properly tended. Therefore, to get the very most from a plantation, be prepared to do additional work.

Soil and drainage conditions may dictate which tree species may be selected for a site. Improper selection of species can result in poor growth or plantation failure. It may be years before it is clear that different species should have been planted. Ask professionals for help when selecting species. Such help is available at no cost from all district offices of MNR and most CAs.

Information on planting and maintenance is found in the "How to" section.

The table below compares some of the costs and benefits of coniferous vs. hardwood plantation types. To get more benefits, more work and money are generally needed. It also shows that the low maintenance conifer plantation offers many environmental benefits.

COSTS AND BENEFITS OF PLANTATION TYPES

	CONIFER PLANTATION	MIXED PLANTATION	HARDWOOD PLANTATION
SITE PREPARATION	Low	Moderate	High
PLANTING NON SUBSIDIZED	Low	Moderate	Moderate
WEED CONTROL	Low	Moderate	High
PROTECTION FROM ANIMALS	Low	Moderate	Very High
HABITAT VALUE	Moderate	High	Moderate -High
POTENTIAL TIMBER VALUE	Moderate-High	Moderate-High	Moderate-Very High
GENERAL ENVIRONMENTAL BENEFITS	Moderate	High	Moderate

Plantations should be thinned out periodically.

The Details:

Changing to a crop that requires less management input and less cultivation is a good solution for both fragile and marginal land. For example, permanent hay or pasture may replace row cropping. Reforestation provides a way to retire land. Although it is commonly called retirement, the land can be very productive, both environmentally and economically, while growing a forest.

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The table below compares some of the costs and benefits of coniferous vs. hardwood plantation types. To get more benefits, more work and money are generally needed. It also shows that the low maintenance conifer plantation offers many environmental benefits.

	MIXED PLANTATION	HARDWOOD PLANTATION
	Moderate	High
	Moderate	Moderate
	Moderate	High
	Moderate	Very High
	High	Moderate -High
	Moderate-High	Moderate-Very High
	High	Moderate

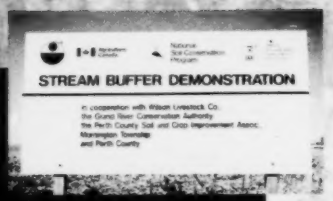
A Summary:

Buffer strips are made up of vegetation which protects natural features from surrounding land uses.

USEFUL AROUND:	▸watercourses and shorelines ▸ponds and wetlands ▸woodlots
FAVOURED SPECIES:	▸depends on secondary objective e.g. wildlife habitat improvement project might use cedar for cover, along with berry or nut-producers for food. If producing valuable woods is important, black walnut, ash, silver maple and red oak are likely suitable
ADVANTAGES:	▸keep farm equipment and livestock away from fragile streambanks ▸trap eroding nutrients & sediment before they reach water ▸use captured nutrients to improve tree growth ▸reduce streambank or shoreline erosion ▸shade stream to lower water temperature ▸reduce algae growth and its depletion of oxygen ▸provide base for natural stream food chain ▸improve fish and wildlife habitat ▸provide ideal connecting corridors ▸use productive soils for tree crops ▸increase property values
DISADVANTAGES:	▸may conflict with tile drains ▸tree establishment can be difficult because of very strong competition from grass and weeds ▸lost acreage ▸flood damage to trees (ice or water) ▸may harbour nuisance animals near fields
ESTABLISHMENT COST:	▸low if subsidized, otherwise moderate
PROFIT POTENTIAL:	▸moderate
PROFIT HORIZON:	▸long
SITE PREPARATION:	▸see Information & Assistance below
ESTABLISHMENT:	▸assistance available
MAINTENANCE:	▸mulch or herbicide to reduce competing vegetation
INFORMATION & ASSISTANCE:	▸OMAF should be contacted regarding status of cost-sharing programs to promote buffer strips on agricultural land. CAs and MNR offer nursery stock, on-site advice, and planting assistance. All construction activities affecting watercourses and wetlands must be cleared through MNR and the CA

This buffer is only a few years old and has already improved fish and wildlife habitat.

Water quality suffers in streams without buffers.



A buffer strip along a stream is an important environmental priority.

The Details:

Every plumber knows that water runs downhill and every landowner should know that any impacts on water quality will flow downstream. Water quality in the Great Lakes and the St. Lawrence River depends on the quality of water flowing into all the small streams and ditches farther inland. Most of what farming or other human activities add to water is harmful. It makes sense to put some distance between the source of the problem and the receiving stream.

Stream protection and rehabilitation are high priorities. Many programs are available to assist in such projects. Check with OMAF, MNR and CAs for details.

The wider the buffer strip, the greater the effectiveness. For minimum protection, a three-metre buffer is considered adequate unless overland flow is very strong. Other factors to consider in deciding the width are: land values, potential floods, ice scouring of trees and project goals.

The strength of overland flow is affected by the degree length of slopes and soils; up-slope cropping practices can also greatly affect flow. Strip cropping, conservation tillage and residue management are effective methods for slowing down water flow. Please refer to the Field Crop Production booklet for more information.

Stream-side buffers can be planted with trees and shrubs or left in grass. Grass may be preferable where conflict between tree roots and tile drains is likely or when ice scouring occurs regularly.

Any construction that alters a watercourse including dams or ponds must be cleared by both MNR and the CA. Fish habitat is protected under federal laws. Plans for plantings along municipal drains should be discussed with the township or county engineer so that maintenance requirements can be met.

Trees help to stabilize river banks but are vulnerable to extreme flood flows and ice damage.

Treed buffer strips act as shelterbelts, give shade to cool stream water, filter sediment coming off fields and provide habitat, wood production areas and recreational settings. Tree roots can capture nutrients before they enter and harm a watercourse. Streambanks are stabilized by roots and stream flow is more consistent. Stream-side buffer strips offer the opportunity of linking natural areas.

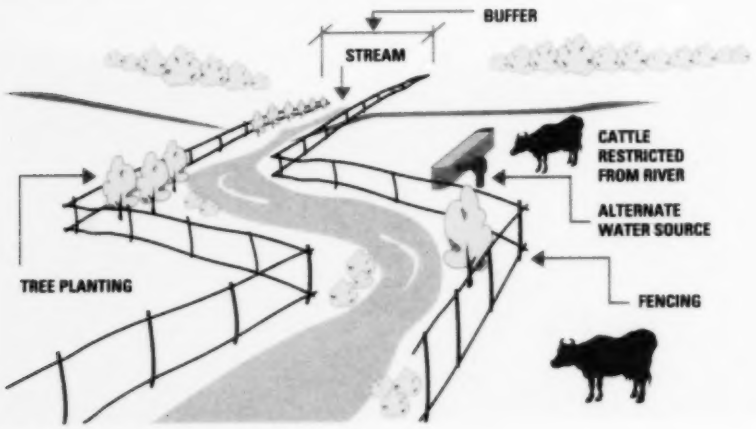
Flood waters are a risk to trees because of the damaging ice they may bring into a buffer strip. Large pieces of ice can destroy or injure small trees. Get advice from a person familiar with local flooding and ice conditions and combine that knowledge with professional forestry advice.

Where there is high risk of ice damage, it may be advisable to start with willows or other species which tolerate ice damage. When they become established, less tolerant trees can be planted in the protected areas.

In pasture land, fencing off a stream is the greatest environmental improvement that can be made. It will improve water quality and wildlife habitat (including fish habitat). The benefits increase if trees are planted in the fenced buffer. Where fencing is not feasible, simple changes such as moving salt blocks and hay feeders away from the stream will help reduce livestock access.

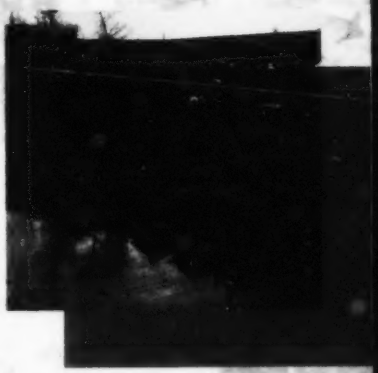
Where equipment access is needed, low-level crossings can be installed. Where cattle access to both sides of the watercourse is essential, small "bridges" with culverts can be constructed. In this way, mud is not stirred up and livestock wastes do not enter the watercourse. Alternate watering devices are available so that livestock do not have to drink from the stream.

Shorelines of lakes and ponds should be buffered from cropland and pasture using the same techniques. They are unique and important habitats. Wetlands also benefit from protection. Where shoreline erosion is a problem, contact the CA or MNR regarding solutions.



Methods to improve water quality in pastures.

Beaver damage is yet another hazard to treed buffer strips.



Intensive grazing practices have destroyed a natural buffer strip.

Wildlife and their habitat are inseparable.

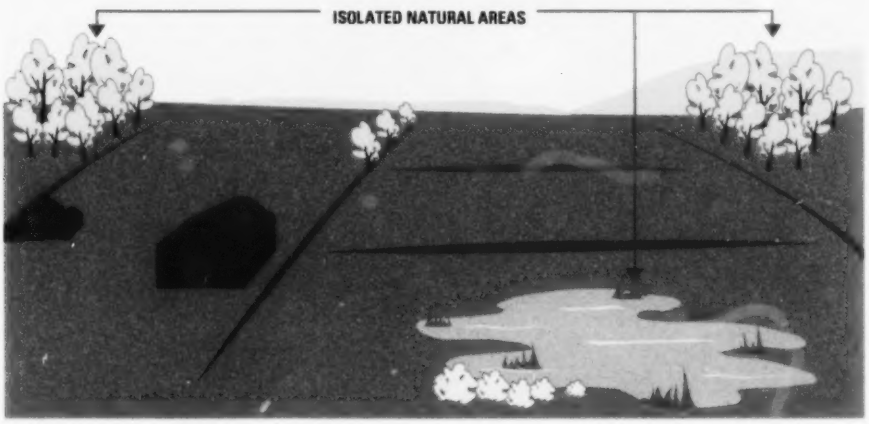
Animals need water, shelter and food to survive and reproduce. Habitat refers to all the things which added together meet these needs.

The needs of each species are unique. Habitat can be managed for one or many species. When conditions improve for one species, they may, at the same time, become less favourable for some other animal. All landscapes offer habitat to some form of wildlife; even abandoned fields are valuable habitat for some species. The key to having a great variety of wildlife is to have a great variety of habitat. If you wish to encourage a particular species, appropriate strategies can be developed.

Today, most natural areas are small fragments of what they once were. They are islands of green separated by cropland and pasture. As these islands become smaller, and as the distance between them increases, fewer species are able to make use of the habitat.

Habitat management needs to be well-planned to be successful. Factors to consider include:

- ▸ Landowner's goals (e.g. nature appreciation, hunting, nuisance animal control).
- ▸ Existing wildlife populations.
- ▸ Present use of wildlife.
- ▸ Existing habitat.
- ▸ Opportunities to improve habitat, especially with buffers, on marginal and fragile land.
- ▸ Availability of funding, labour, maintenance, materials.
- ▸ Restricting access of nuisance animals to newly-established habitats.



Islands of green are all that remain of the original forest that once blanketed Ontario's farm areas.

MNR, CAs, Ducks Unlimited and the Ontario Federation of Anglers and Hunters should be contacted for assistance from habitat management specialists.

Moving from plan to action requires some knowledge of habitat improvement techniques. How can habitat be improved? It's as easy as A, B, C.

A: Add to (or augment) existing features to increase habitat value and size. E.g. provide food producing plants in strategic places or put up nesting boxes; increase the size of natural areas.

B: Buffer existing habitat features. E.g. plant trees beside a stream or wetland.

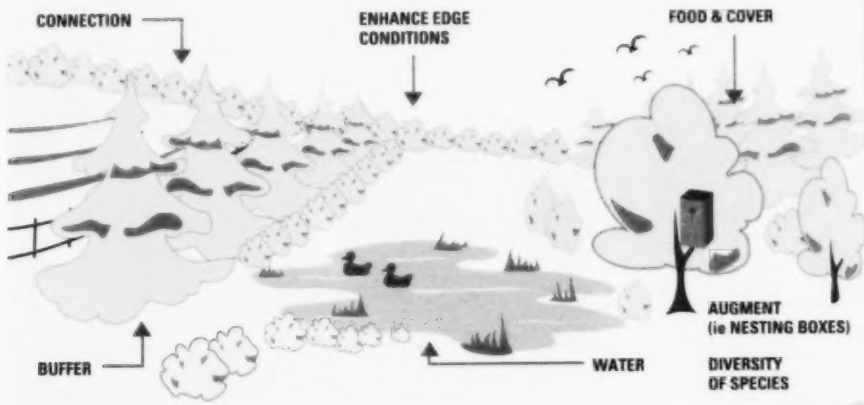
C: Connect islands of green to each other with fencerows, windbreaks and buffer strips. This should be done with caution because linkages may benefit predators or nuisance animals more than other animals.

D: Diversify habitat to benefit different types of animals. E.g. if most of the trees on your property are hardwood, consider planting evergreens because they offer good shelter.

E: Enhance the edge where two types of habitat come together. Make the edge longer, wider or more diverse. Because edges offer two different habitats, they are generally used by more species of wildlife than either habitat alone.

F: Fence, where necessary, to limit wildlife to planned habitat areas.

These general guidelines will help improve habitat in most situations, but they are not universally true; some animals need a very large, uniform area of habitat to survive.



Wildlife habitat can be improved by using these methods.

Woodlands offer excellent habitat for many species. They can often be improved with the following:

- ▸ Buffer and add to woodland by planting trees around it.
- ▸ Provide evergreen cover if none exists.
- ▸ Encourage variety in plant species and ages.
- ▸ Encourage food-producing plants such as nut trees, berry-producing shrubs and wild apple trees.
- ▸ Ensure that enough trees with holes suitable for nesting are maintained for the needs of cavity-dwellers, such as squirrels, raccoons, owls, woodpeckers and wood ducks.
- ▸ Dead trees and snags (topless trees) are important bird and small animal habitat and often become nesting trees.
- ▸ Brush and old logs on the ground are important as cover or as drumming sites for grouse.

Wetlands are among the most productive habitats. Marshes and swamps are the most common types in Ontario farmland. Acidic bogs occur in some areas.

Den trees are a crucial element of woodland habitat.

CAs regulate the alteration of some wetlands in Ontario. The protection of all wetlands is also encouraged by MNR and by municipalities through the land use planning process. These agencies should be consulted before undertaking any activity that may affect a wetland, such as draining or filling. Property tax relief may be available for owners of "provincially significant wetlands" and certain other natural areas; contact MNR for more information.

Wetlands are valuable because of their important role in the water cycle and in providing wildlife habitat and recreational opportunities. Wooded wetlands, such as swamps, may safely yield valuable wood products when carefully thinned out.

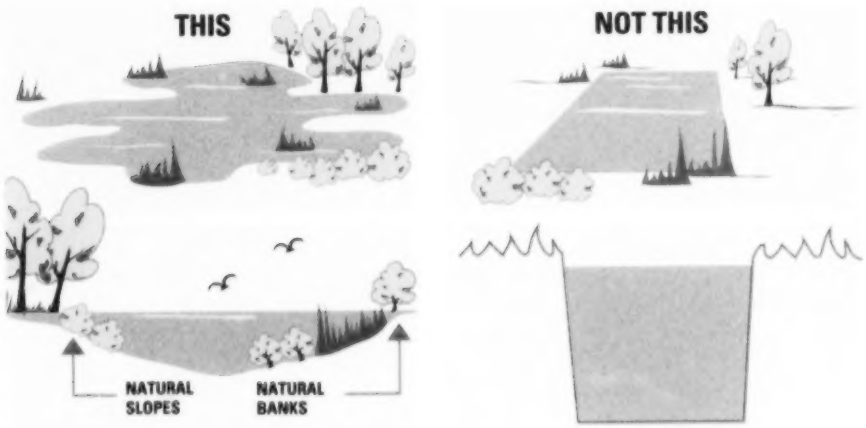
One useful method for protecting wetlands is to buffer them from direct contact with erosion, pesticides and nutrients. This can be accomplished with a buffer strip (please see page 23). Livestock should not be allowed to graze in wetlands.

Each wetland is unique, and changes should not be made without expert guidance. Contact wildlife biologists at MNR, CAs, Ducks Unlimited, or the Ontario Federation of Anglers and Hunters.

Ponds can be improved through design and management techniques. Pond design should create variety in profile and outline as shown in the illustration. Aim for 50% open water and 50% aquatic plants. Geese do not favour ponds or wetlands surrounded by shrubbery. Therefore, promote growth of woody plants around these areas to encourage ducks which may otherwise be displaced by geese.

Where habitat is suitable for ducks, it may be a disadvantage to link the area with other habitat. This may make it more likely for raccoons, foxes and other predators to reach and destroy duck nests.

Ponds which are created as part of a watercourse are harmful to water and habitat quality. Therefore, permits will be required from MNR and the CA for pond construction. A free information package about ponds is available from MNR.



Pond design has great influence on habitat variety.

Wetlands are important because of their valuable role in water storage and as highly-productive habitat.

Wooded wetlands may safely yield valuable wood products when carefully thinned out.

Wildlife habitat can be improved with plantings for food and cover.

A Summary:

All tree, shrub and other plantings designed to improve habitat.

USEFUL WITH:	▸farmstead ▸windbreaks and shelterbelts ▸buffer strips ▸fencerows ▸near water ▸near woodlots/power lines/pipelines
FAVOURED SPECIES:	▸a variety of species, preferably native, that gives good cover, food, and/or nesting sites (see table on page 27)
ADVANTAGES:	▸improve wildlife food availability ▸improve cover for shelter and hiding ▸increase available nesting sites ▸improve beauty and recreation ▸increase property value
DISADVANTAGES:	▸seedlings often eaten before bearing fruit ▸little or no economic return ▸may draw nuisance animals
ESTABLISHMENT COST:	▸moderate
PROFIT POTENTIAL:	▸low to moderate
PROFIT HORIZON:	▸the profit is not counted in dollars
SITE PREPARATION:	▸cultivation if possible
ESTABLISHMENT:	▸protection from rodents and weeds
MAINTENANCE:	▸mulching or herbicide
INFORMATION & ASSISTANCE:	▸Contact local landscapers for advice around the farmstead. For other projects, field staff familiar with wildlife management and/or forestry from MNR or your CA should be contacted for on-site advice, nursery stock, and assistance programs. You may wish to contact one of the following interest groups as well: Fed. of Ont. Naturalists, 355 Lesmill Rd., Don Mills, Ontario, M3B 2W8, (416) 444-8419 Ont. Fed. of Anglers and Hunters, Box 28, Peterborough, Ontario, K9J 6Y5, (705) 748-8324
REFERENCE:	▸Community Wildlife Involvement Program Field Manual (Ministry of Natural Resources)

GROWTH FORM	WILDLIFE USE
Tall shrub, 2-4m to moist sites (not dry)	Song/gamebirds use this although mainly as winter nourishment
Small shrub, < 2m, forms thickets	Songbirds eat berries; rabbits, hare and deer browse twigs; cover for gamebirds
Shrub or small tree	Song/gamebirds, eat berries
Tall shrub, 7-10m	Many birds eat berries; rabbit and deer browse twigs; nesting
Shrub, 1-5m	Song/gamebirds, red squirrels, chipmunks and mice eat berries; deer and rabbits browse
Groups of shrubs, 2-5m	Song birds eat fruit; winter food for deer and rabbits
Small tree, 7-13m	Many birds and mammals eat berries; deer browse twigs
Shrub, 2-3m	Many birds eat seeds
Twining vine, 5-8m	Birds and some small mammals eat fruit; good cover
Low rambling vine	Birds eat berries; good cover
Low spreading tree, 8m	Deer, rabbits and grouse eat fruit; good for nesting
Vine, 6-13m	Birds and mammals eat fruit; good cover and nesting
To 3m	Song/gamebirds and mammals eat nuts

* All plants offer food to animals. Only a few shrub species are listed because they can be used by many species and also improve habitat.

NATIVE SHRUBS FOR WILDLIFE FOOD*

NAME	SOILS/MOISTURE	GROWTH FORM	WILDLIFE USE
HIGHBUSH CRANBERRY	Fertile soil/well-drained	Tall shrub, 2-4m to moist sites (not dry)	Song/gamebirds use this although mainly as winter nourishment
RED-OSIER DOGWOOD	Fertile soils/moist to wet sites	Small shrub, < 2m, forms thickets	Songbirds eat berries; rabbits, hare and deer browse twigs; cover for gamebirds
ALTERNATE-LEAVED DOGWOOD	Most soils/moist best, tolerates dry	Shrub or small tree	Song/gamebirds, eat berries
NANNYBERRY	Moderately fertile/ average to wet sites	Tall shrub, 7-10m	Many birds eat berries; rabbit and deer browse twigs; nesting
ELDERBERRY	Well drained loam or sandy soil/well-drained to moist sites	Shrub, 1-5m	Song/gamebirds, red squirrels, chipmunks and mice eat berries; deer and rabbits browse
STAGHORN SUMAC	Can grow in very poor soil/well-drained to dry sites	Groups of shrubs, 2-5m	Songbirds eat fruit; winter food for deer and rabbits
SERVICEBERRY	Sandy loam/dry-average	Small tree, 7-13m	Many birds and mammals eat berries; deer browse twigs
NINEBARK	Rich, well-drained/floodplain	Shrub, 2-3m	Many birds eat seeds
BITTERSWEET	Most soils/dry-average	Twining vine, 5-8m	Birds and some small mammals eat fruit; good cover
VIRGINIA CREEPER	Most soils/dry-average	Low rambling vine	Birds eat berries; good cover
WILD APPLE	Well-drained loam/clay loam/moist	Low spreading tree, 8m	Deer, rabbits and grouse eat fruit; good for nesting
WILD GRAPE	Rich soils/average moist	Vine, 6-13m	Birds and mammals eat fruit; good cover and nesting
AMERICAN HAZELNUT	Most soils/well-drained	To 3m	Song/gamebirds and mammals eat nuts

* All plants offer food to animals. Only a few shrub species are listed because they can be used by many species and also improve habitat.

Intercropping is a widely-spaced grid of trees with field crops grown in between.

A Summary:

Intercropping refers to the practice of growing field crops and tree crops at the same time, on the same land. Trees are planted on a widely-spaced grid which allows crop production to continue between tree rows. Trees, such as black walnut, which have high timber value and valuable nut crops, are excellent species for intercropping. The land is then giving triple duty: field crops, annual tree crops and long-term timber crop. Intercropping can be used to increase cash returns on the farm's productive land, or as a method of retiring fragile or marginal land without immediately giving up annual income from field crops.

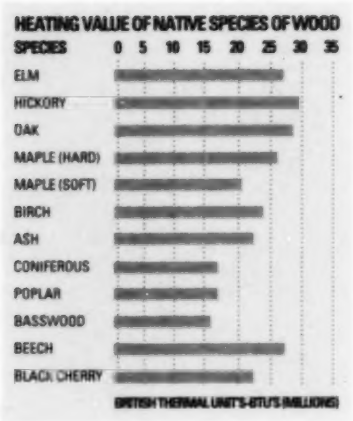
USEFUL WITH:	▸cropland ▸fragile land
FAVOURED SPECIES:	▸black walnut, red oak, sugar maple, any species that can produce valuable crops in field situation (such as nut trees)
ADVANTAGES:	▸can be very profitable in long-term ▸maintain income in short-term ▸trees produce timber, fuelwood, food ▸protect and improve soil ▸improve wildlife habitat ▸beautify ▸increase property value ▸recreation ▸shelter field crops ▸maintain young trees through field work (herbicide, fertilizer)
DISADVANTAGES:	▸inconvenience of working fields within a grid of trees ▸long-term markets impossible to predict ▸some trees and crop inputs are incompatible
ESTABLISHMENT COST:	▸moderate to high
PROFIT POTENTIAL:	▸moderate to high
PROFIT HORIZON:	▸depends on tree species; seven to 20 years for nut crops, 15 to 20 years for fuelwood from thinnings, 40 to 80 years for timber. Income from field crops is maintained during the waiting period
SITE PREPARATION:	▸very precise layout/tillage/strip herbicide
ESTABLISHMENT:	▸moderate; careful field work
MAINTENANCE:	▸pruning for timber and crop production, may require orchard-like maintenance with some species
INFORMATION & ASSISTANCE:	▸University of Guelph (Agroforestry), Ridgetown Agricultural College, CAs, MNR, Society of Ontario Nut Growers, R.R. # 3, Niagara-on-the-Lake, Ontario, L0S 1J0, (416) 835-8773, Commercial Association of Nut Growers of Ontario
REFERENCE:	▸Nut Culture in Ontario, OMAF Publication # 494

A Summary:

Silvipasture allows for the production of trees and livestock on the same land, at the same time. Do not confuse this with the very harmful practice of grazing natural woodlands. Silvipasture involves tree establishment and protection on pasture land. The key to successful silvipasture is carefully controlling livestock access and forage management.

USEFUL WITH:	▸pasture ▸marginal lands
FAVOURED SPECIES:	▸valuable timber or nut trees
ADVANTAGES:	▸double duty from pasture ▸shade and shelter for livestock ▸improve bird habitat ▸beautify ▸improve recreation ▸provide timber, fuel, nuts, syrup ▸increase property value ▸suits phased pasture retirement
DISADVANTAGES:	▸compacted pasture soils may slow tree growth and reduce health ▸cattle can easily damage trees and root systems ▸tree protection methods may be costly or inconvenient
ESTABLISHMENT COST:	▸moderate to high
PROFIT POTENTIAL:	▸moderate to high
PROFIT HORIZON:	▸generally long
SITE PREPARATION:	▸may include herbicide or cultivation
ESTABLISHMENT:	▸protection from livestock
MAINTENANCE:	▸forage management, tree protection, pruning
INFORMATION & ASSISTANCE:	▸University of Guelph (Agroforestry), Ridgetown College of Agricultural Technology, CAs, MNR

Silvipasture is growing trees and livestock at the same time, on the same land.



WOODLAND MANAGEMENT

With good management, woodlands have the potential to be more profitable than most other farm land on a per acre/per year basis. As an added bonus, they offer many environmental benefits.

Three important facts are:

- ▸ Forests provide a multitude of benefits to the environment without being managed.
- ▸ Actively managing a forest can make it even more productive in many different ways.
- ▸ MNR forestry and wildlife management staff offer free advice and tree marking if you wish to actively manage your woodlot. To get double duty from woodlot and wildlife habitat, see page 26.

Managed forests are property tax free if they qualify under the Managed Forest Tax Reduction Program. For more information, contact MNR. For information regarding woodlot owners' associations, contact the Ontario Forestry Association, Suite 209, 150 Consumers Road, Willowdale, Ontario, M2J 1P9.

Nature's way of gradually reforesting areas is called succession.

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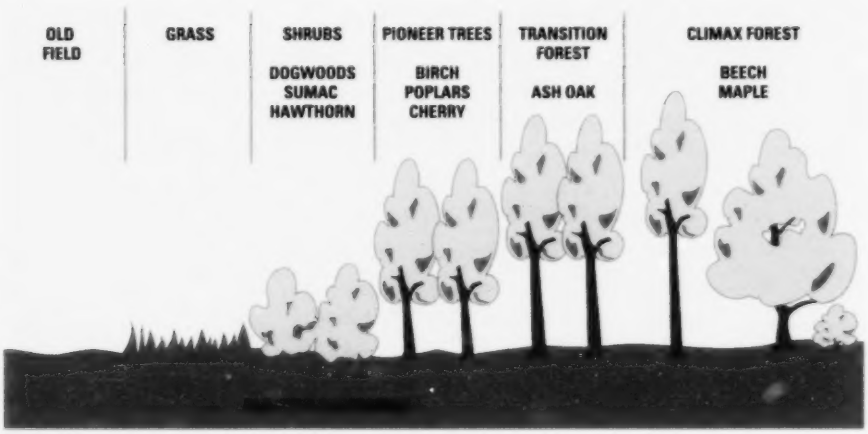

Nature's way of gradually reforesting areas is called succession.

A Summary:

Aims to produce high quality timber and/or fuelwood; fuelwood is often a secondary product of timber production.

USEFUL WITH:	▸existing hardwood bush ▸intercropping ▸silvipasture ▸buffer strips ▸all areas of the farm where trees are growing
MOST FAVOURED SPECIES:	▸valuable timber trees include oak, maple, ash, black cherry, black walnut, white pine, yellow birch
ADVANTAGES:	▸timing of harvest can be adjusted to suit owner and markets ▸income available as needed ▸winter work ▸profitable ▸on-farm use of products ▸wildlife habitat ▸recreation ▸limited investment required (e.g. machinery)
DISADVANTAGES:	▸over-emphasis on timber may create inferior wildlife habitat (removal of trees with nesting holes, etc.) ▸can be dangerous - never work alone
ESTABLISHMENT COST:	▸none for existing woods
PROFIT POTENTIAL:	▸moderate to high
PROFIT HORIZON:	▸thinned/harvested every 10 to 15 years
SITE PREPARATION:	▸none for existing woods
ESTABLISHMENT:	▸none for existing woods
MAINTENANCE:	▸monitor forest health between thinnings
INFORMATION & ASSISTANCE:	▸MNR provides free on-site advice, tree marking, and marketing assistance
REFERENCE:	▸Wood ... Take a Stand and Make it Better, MNR. Directory: Primary Wood-Using Industries in Ontario 1988, MNR. Help ... For Landowers Who Want to Branch Out, MNR. The Logger's Pocketbook, MNR.

Well-managed woodlands can yield very profitable timber products.

Posts and poles are valuable for on-farm use.

POST AND POLE PRODUCTION

Summary:

Production of fence posts and poles from existing woodland or plantations.

USEFUL WITH:	▶ any woodland containing the desired species ▶ double duty for many plantings
MOST FAVOURED SPECIES:	▶ white cedar, red pine, tamarack, black locust, jack pine, white pine (poles)
ADVANTAGES:	▶ on-farm use ▶ traditionally good market ▶ wet sites okay for cedar and tamarack ▶ winter work ▶ wildlife habitat ▶ recreation
DISADVANTAGES:	▶ tree value not as high as for quality timber ▶ care required to avoid uprooting of trees by wind
ESTABLISHMENT COST:	▶ none for existing woodland
PROFIT POTENTIAL:	▶ moderate
PROFIT HORIZON:	▶ varies
SITE PREPARATION:	▶ none for existing woodland
ESTABLISHMENT:	▶ see plantation information
MAINTENANCE:	▶ monitor forest for health between operations. Re-establishment of harvested cedar may present unique problems because of site and species characteristics. On-site advice from forestry staff will help avoid problems with uprooting of trees and regeneration
INFORMATION & ASSISTANCE:	▶ MNR provides free on-site advice, tree marking and marketing assistance
REFERENCE:	▶ Plantation Management, MNR

THE SUITABILITY OF VARIOUS SPECIES AS WOOD PRODUCTS

	POST AND POLES	PULPWOOD	FUELWOOD	LUMBER
PINE, SPRUCE	S	VS	S	S
WHITE CEDAR, TAMARACK, BLACK LOCUST	VS	–	S	S
POPLAR	–	S	S	S
OAK, WALNUT, BLACK CHERRY, YELLOW BIRCH, ASH, SUGAR MAPLE	–	–	VS	VS
OTHER HARDWOODS	–	–	VS	S
OTHER EVERGREENS	–	S	S	S

S = Suitable VS = Very Suitable – = Not Suitable

Pests and poles are valuable for on-farm use.

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Production of fence posts and poles from existing woodland or plantations.

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PULPWOOD	FUELWOOD	LUMBER
VS	S	S
–	S	S
S	S	S
–	VS	VS
–	VS	S
S	S	S

S = Suitable VS = Very Suitable – = Not Suitable

CASE STUDIES

Imagine a very stony slope running the width of three neighbouring farms. Each family handles the retirement of their strip of marginal land differently, yet each family does the right thing for the land and their own needs.

The **Smith** family decides to convert their piece of rough land to a forest of timber and nut-producing trees. Each year, another acre of trees is planted and the electric fence is moved to the new edge of the forest to keep livestock from damaging the trees.

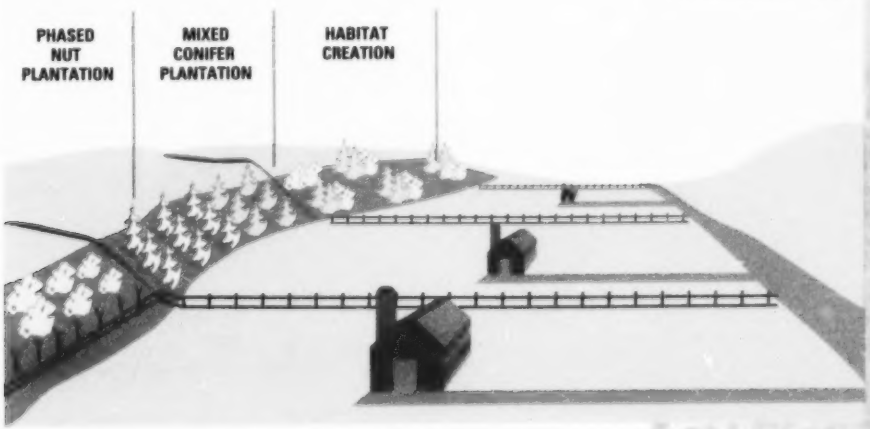
They need to budget carefully for the purchase of specialty stock. By planting a small portion of their area each year, the high cost of nursery stock and maintenance is spread out.

Each year, the forest gets one acre larger and the pasture gets one acre smaller. Income from the pasture helps pay for the trees and the workload is spread over many years. Planting and maintenance do not become a burden.

The **Jones** family signs a reforestation agreement with a government agency to establish a mixed plantation. It is designed to be low maintenance while providing many wildlife and forestry benefits.

The plantation is mainly evergreens with a mix of hardwoods. The plan is to thin out the evergreens over time to allow the hardwoods room to grow. Natural seeding from nearby maple and ash trees will add to the hardwood component. The end result after many decades will be a forest that is mainly hardwood.

The **Brown** family noticed that since they stopped pasturing the rough field, hawthorns and wild apples that have sprung up. They provide excellent food and nesting sites for birds and food and bedding sites for deer.



Three different approaches to marginal and fragile land retirement.

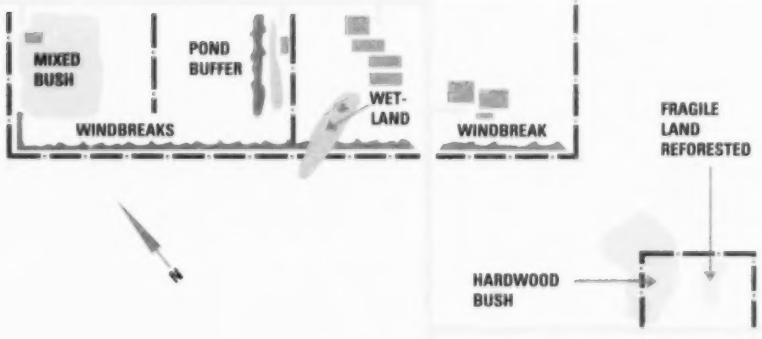
Reforested fragile land.

The Browns decided to plant a dense swath of cedar trees to create cover for wildlife. Berry-producing shrubs are planted in clumps throughout the area to improve the availability of wildlife food. A picnic area and trail system are established. The Browns use the area for walking, skiing, hunting, snowmobiling and nature appreciation.

There are as many correct strategies as there are landowners. Some real-life case studies are presented here to show the range of possibilities.

LOCATION:	▸East Garafraxa Township, Dufferin County	
SOILS:	▸mostly sandy loam	
SIZE:	▸450 acres (180 ha) total, 360 acres arable	
FARM OPERATION:	▸25,000 broiler chickens, 40 head dairy herd corn/barley/alfalfa rotation in equal portions	
NATURAL AREAS:	▸hard maple bush	22 acres (9 ha)
	plantation	6 acres (2.4 ha)
	wetlands	10 acres (4 ha)
	ponds and buffers	6 acres (2.4 ha)
	mixed woods	34 acres (14 ha)
	total	*78 acres (31.5 ha)*
FARM FORESTRY:	▸windbreaks, pond and wetland buffers, habitat enhancement, marginal land reforestation, timber management, roadside shade trees	

This family is striving to farm their land on a sustainable basis. Already the farm property is 18% natural area, but the farmer plans to increase this by widening buffer strips upslope from his natural ponds. He recognizes the windbreak value of existing fencerows and augments natural fencerows with planted windbreaks.



Farm plan showing farm forestry and habitat management projects.

The farmer, in this example, makes every effort to consider the needs of wildlife on the farm. This extends to leaving an uncut buffer around ground nesting birds discovered at haying time. He also appreciates the presence of coyotes and hawks; since they have become more common on his farm, groundhogs and mice have declined.

Three agencies have cooperated with the family in their resource management activities: the Grand River Conservation Authority, MNR and Ducks Unlimited.

Shade trees were planted in 1979 next to a pasture. In 1985, a tree planting plan was drawn up and implemented with the help of the CA. A windbreak system, buffers for natural ponds and wetlands, and the reforestation of some dangerously steep hills, were all included. In following years, some areas were re-planted, buffers were expanded, more shade trees were planted, and wildlife food producing plants were planted next to the wetland.

In addition to the extensive tree planting efforts, the family entered cooperative ventures with Ducks Unlimited and MNR. The Ministry marked the hardwood bush in the early 80's and a contractor was hired to take out firewood and timber. Although the operation was profitable, the farmer feels that in the next thinning he will put greater emphasis on habitat improvement. Ducks Unlimited installed a water level control structure and berms around the wetland to maintain more consistent water levels. This effort was aimed at increasing the value of the wetland for waterfowl and was augmented by the shrub and buffer plantings.

The farmer has also made changes in tillage and erosion control to help prevent soil erosion. Chisel plowing is used for almost all their needs. At four locations where gully erosion was a problem, berms have been installed to interrupt the flow of water and settling basins are drained by the familiar orange tile inlets. All manure applied to fields is incorporated into the soil within 24 hours to minimize its movement.

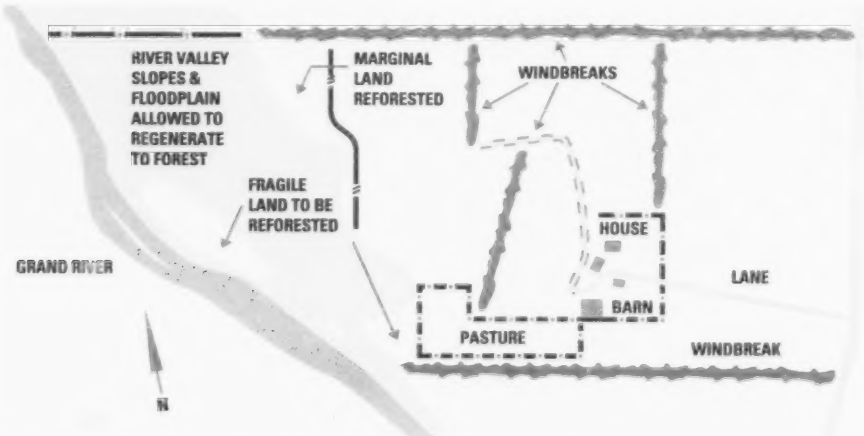
The family has changed its farming methods as information and technology become available to ensure that their operation is not harmful to the environment.

Wood chip mulch can be used in tree establishment.

LOCATION:	▸Woolwich Twp., Region of Waterloo	
SOILS:	▸silt loams, loam, and clay loam, with gravelly patches in the river valley	
SIZE:	▸120 acres total, 70 acres arable	
FARM OPERATION:	▸30 Holsteins	
NATURAL AREAS:	▸sugar bush	6 acres (2.4 ha)
	cedar bush	16 acres (6.5 ha)
	plantation	6 acres (2.4 ha)
	floodplain	5 acres (2.0 ha)
	marginal land	4 acres (1.6 ha)
	total	*37 acres (15 ha)*
FARM FORESTRY:	▸400 tap sugar bush, cedar post and pole harvest, conversion of cedar bush to hardwood, comprehensive windbreak system, marginal land reforestation (mixed species), riverbank protection with Austrees; upcoming projects include: 4 acres reforestation on fragile land (floodplain), 4 acres reforestation on marginal land (steep stony slopes of river valley) and potential for 10 acre intercropping project	

This farm is an excellent example of adjusting operations to the resources of the land. Today, 31% of the farm is in natural areas, which represents the steep valley slopes and floodplain along the Grand River. In 1949, when the farmer's father bought the farm, all of these marginal and fragile lands were being grazed.

The philosophy is to protect the farm's fragile areas but the farmer expects them to generate revenues. The sugar bush has grown from a 200 tap operation in 1950, to 400 taps in 1992. Even more taps will soon be possible as more trees mature. Cedar posts



Farm plan showing farm forestry activities.

and poles are continuously being harvested from areas that were pastured prior to 1949. All plantings are designed to have saleable products as soon as possible and to accomplish double duty.

The farmer's father fenced a small area of sugar maples in 1950. Also in 1950, a plowed field next to the sugar bush sprouted a bumper crop of sugar maple seedlings. It was decided to enlarge the sugar bush by not cultivating that part of the field. In 1972, another section of the river valley and floodplain was fenced off from grazing, and finally in 1988, the farmer decided to keep the cattle completely out of the river valley and to reforest any areas which were still open.

The farmer's varied experience has taught him much about farming with nature. He feels that grazing-induced soil compaction prevented natural regeneration for up to 35 years after fencing out the cattle! Because it took so long to see regeneration, there was little incentive to exclude cattle from other areas. However, after 30 or 35 years the regrowth was so impressive that it convinced him to allow all of the river valley to regenerate to forest.

The value of mulching has become evident. In order to give maximum advantage to his planted trees, he is applying wood chip mulch around many of them.

The lessons learned from the cedar bush have been applied to the design of the plantations. His 1992 project includes the reforestation (by Grand River Conservation Authority) of fragile floodplain land and marginal valley slopes.

The plantations are designed to mimic the succession process that the farmer has studied in the cedar bush. Cedars make a good pioneer plant in the open fields and provide a saleable product within two or three decades. The growth of existing hardwoods mixed within the cedars is encouraged when the cedars are removed.

HOW TO

[redacted]

Follow the step-by-step planning process outlined in the planning section of this booklet on page 9. By combining that outcome with your own experience and the advice of extension staff (where needed), you will have a good plan. There is plenty of help available from the various sources listed throughout this booklet. It is worthwhile to call as early as possible.

[redacted]

Order early! The supply of trees from MNR nurseries cannot always keep pace with demand. Trees will be ordered by the agency that plants trees for you if you are using a planting assistance program. If you wish to plant the trees on your own, call the local MNR office and ask for an "Application for Nursery Stock".

Get your request for planting assistance to the appropriate agency as early as possible. The demand for planting assistance often exceeds the funds available to do the planting so that an early application has the best chance of getting trees and assistance. Private nurseries provide a reasonable alternative for seedling trees and larger stock.

[redacted]

Nursery stock is very vulnerable when it is being transplanted. Most of the stock that is used for the projects mentioned in this booklet, is dug, stored, and shipped with bare roots.

Bare-root trees are inexpensive to handle, compared with moving a root ball of earth, or a pot. It also creates stresses on the tree. They have no resources to draw on except what is already inside of them.

Stress in trees adds up over time. Each new injury makes it a little less likely that the tree will survive and grow quickly. Every time that a tree bag is dropped, every second that an exposed seedling is held in the hand, every hour a tree bag is left in the sun, or every day that trees are stored in less than ideal conditions, the tree is one step closer to death. If the tree is not properly stored and handled until the time of planting, then the planting exercise is just that: good exercise.

Ideal storage is 1 or 2° C. with 100% humidity. Trees in bags should never be stored at temperatures above 10° C. or below freezing. Bagged trees stored at temperatures above 2° C. will begin to heat up inside the bag. This causes major damage to the tree. Trees also need to be kept moist while being transplanted and stored.

Trees should be planted as soon as possible after they are lifted.

Important Note

Many landowners get their nursery stock from MNR. It is illegal to sell or give away these trees as nursery stock (under the the Forestry Act). When landowners receive government assistance in planting trees, an agreement forbids any re-sale or destruction of the trees within a 15-year time period.

[illegible]

Instructions for tree planting are printed on the outside of MNR tree bags. Proper planting of bare-root trees requires:

- ▸Use of a planting pail: prepare the hole before pulling the tree from the pail.
- ▸All roots fanned out below ground level.
- ▸Planting hole deep enough for root system.
- ▸Soil at root collar*.
- ▸No air pockets.
- ▸Tree firmly tamped in.
- ▸Stem straight.

Container stock needs to have a covering of soil over the top of the "plug".

The "complete tree planter" demonstrates one way of protecting tree roots from sun and wind during planting.

[illegible]

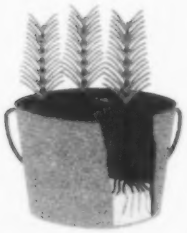
The most important things that can be done for trees are listed below:

- ▸Keep competing vegetation to a minimum, especially for hardwoods.
- ▸Water during droughts if possible.
- ▸Mulch if possible.
- ▸Monitor health and insect/disease damage.
- ▸Protect hardwoods from rodents, deer, rabbits.

The two most commonly used herbicides in plantation establishment are glyphosate (Vision) and simazine (Princep, Simadex). The control of competing vegetation is important for the growth of the plantation. Forestry extension staff will be able to advise on the merits and use of these two chemicals. For further detail regarding chemical weed control, refer to OMAF Publication # 75.

Maintenance is rewarded with superior growth and survival.

*The root collar is a swelling of the stem between the roots and branches. Pines may be planted with the root collar buried slightly in sandy soils; however, as a general rule, always have the root collar at ground level.



Keeping Your Trees Healthy

The seedlings are carried in a bucket with a few inches of water in the bottom to keep the roots moist and protected from sun and drying winds.

Remember to remove only one tree from the bucket at a time after the planting hole has been prepared.

Placing the Trees in the Ground

Alternate Method. This is to make a shovel cut and then a second at right angles in a "T" or "L" shape. The first cut is opened up by levering the shovel in the second cut. The tree roots are placed in the opened first cut. Roots must be spread out and not jammed in to the ground. Also, be careful that no air space is left around the roots.

How Deep to Plant the Trees

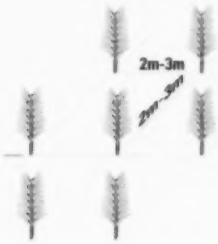
You will know how deep in the ground to plant the tree by finding the "root collar". This is a small enlargement on the stem above the roots.

The root collar must be level with the ground when the tree is planted.

Before You Move On

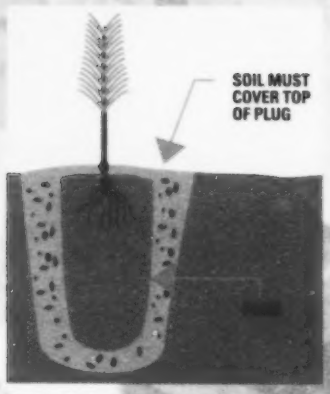
After the tree is planted, the ground around the stem must be packed down with your heel, so that a light tug will not remove the tree.

Be sure that the tree is standing straight up!



Spacing Between Trees

Trees are planted two to three metres apart.



"Plugs" should be covered with a thin layer of soil.

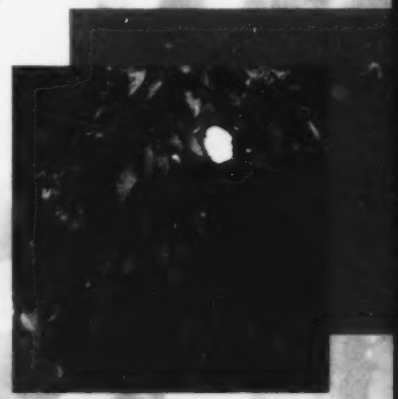
Plantations which are planted on a grid system with two or three- metre spacing are designed to be thinned out after 25 or 30 years (may vary from this range depending on species, site, spacing, and management objectives).

Monitor the plantation for losses. Drought, animal damage and weed competition can cause mortality many years after planting. Depending on the degree of loss and landowner goals, re-planting should be undertaken. A mortality rate greater than 30 or 40% warrants re-planting. Windbreaks should be re-planted wherever gaps might develop. Think of re-planting as an opportunity to get more variety into the plantation.

Firebreaks and trail systems can be put in place either at the time of planting or later. Trails will allow enjoyment of the property and access to trees. Firebreaks can prevent tragedy and should certainly be considered where a plantation is next to a road, railway or another potential ignition source. A firebreak consists of a plowed or mowed strip on the perimeter of the plantation.

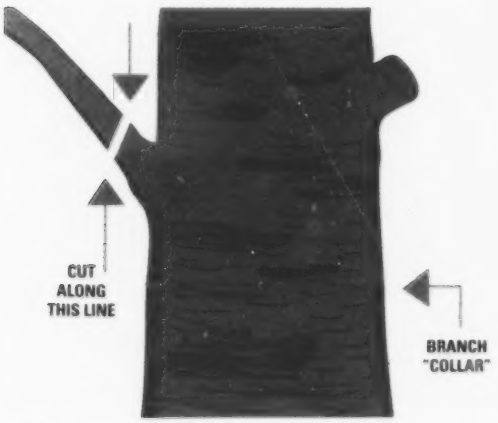
Pruning should be done when timber quality or fruit production are goals. For conifers, prune only 125 to 150 trees per acre. Do not prune trees in rows to be removed in early thinnings. Always leave at least one-third of the tree height with live branches. Never remove more than one-third of the tree's foliage. For timber quality, branches are removed early to the height of the first log. Any diameter growth after pruning will be knot-free. Knot-free lumber is very valuable in species used for veneer. Pruning can also be used to increase crop productivity of fruit and nut trees. See below.

Watch for signs of poor health and call experts for advice if necessary. When a plantation gets large enough that it appears to need thinning, call MNR forestry staff for free tree marking.

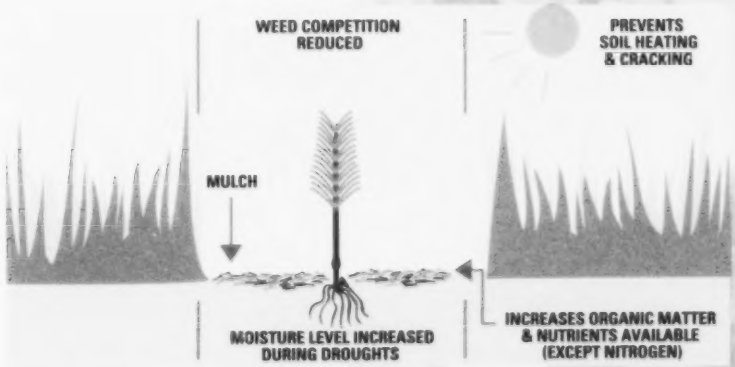


Bindweed smothering ash saplings demonstrates the importance of controlling competition.

Even 10-year-old trees can be girdled and killed by rodents.



Pruning



Mulching has many benefits

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